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The unique requirements of small school facilities, designed to handle multiple curricular functions within the same operational space, necessitate the creation of educational specifications tying the curriculum to that portion of the facility in which each curriculum component will be implemented. Thus, in planning the facility the major concern should be flexibility, to insure maximum utilization of space as well as complete expansion of curricular activities. Technological advances in design (such as open space plans) and construction meterials (such as flooring materials and acoustical treatments) have greatly facilitated the concept of flexible school plants. Advances in the control of illumination and thermal conditions now enable adequate planning for the school environment. Finally, small school libraries should utilize new library technologies for acquiring, storing, presenting, and retrieving materials, while providing a setting designed for individual instruction, one of the special advantages accruing to students enrolled in a small school system. (DK)

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PLANNING REQUIREMENTS FOR SMALL SCHOOL FACILITIES

INTRODUCTION

While it is axiomatic that a small school system must have special advantages over a large school system due to the very virtue of its smallness (just as such a school system must likewise be confronted with unique educational problems stemming from that same reason), it is interesting to note that only infrequently has the small school been the object of review or analysis. By way of underscoring this dearth of relevant commentary, reference to 1968's Educational Facilities Abstract Journal (a publication devoted to capsule reviews of the contents of eight journals of the Council of Educational Facility Planners Abstract Service) reveals that out of 407 abstracted articles only nine could be considered as being remotely related to facility planning for the small school. When it is recalled that an estimated 15 percent of American students are receiving their kindergarten through twelfth grade education in small school facilities rather than in large ones, it is apparent that the former have all too often been brushed aside by educators more intent upon examining the special characteristics of the larger, perhaps more eye-catching, educational plants.

In proposing to delineate special features peculiar to planning for small school facilities there is an obvious underlying presumption that such small schools are not simply quantitatively different from large schools, but that they are qualitatively different as well. The Catskill Area Project in Small School Design (1959) enumerated the salient features of small schools which set them so clearly apart from large schools. Substantially the same points are made in the project of

Educational Facility Laboratories entitled "Designs for Small High Schools" (Nimnicht, 1962). However, before proceeding further it might be wise to examine these differences so that they may serve as a backdrop against which the remarks that follow can be flashed.

Perhaps the enumeration of critical differences between small school and large school facilities should begin with an effort to define the two. While size, of course, is always a relative matter and while recognizing that a large school facility by some standards would be small facility by others, many authorities have nevertheless accepted Conant's judgment that any school with less than one hundred students in the graduating class should be considered as a small school (Conant, 1959).

CONTRASTING FEATURES OF SMALL AND LARGE SCHOOLS

1. The presence of a great many students permits large schools to form multiple classes of the same subject matter, carrying also the important option of grouping students by ability or by special interest. Multiple classes in a single subject, moreover, permit planning one room in which that subject will be taught to successively different groups of students throughout the day. By contrast, small schools typically can muster only enough students to teach a single class in any given subject matter. Afterwards, the instructional space in which that teaching is accomplished must be utilized for other roles in the educational program of the school or it must lie idle and unused--a costly luxury and a glaring daily reminder of poor facility planning.

2. Turning to the teaching staff, large school faculties can most meaningfully be comprised of specialists who, like the specially designed rooms in which they teach, wait for the arrival during the course of each day of successive groups of students to whom they present related blocks of the same subject matter. On the other hand, small schools can scarcely afford to employ a chemistry teacher, for example, who cannot make additional and worthwhile contributions during other instructional periods after completing his presentation to the one chemistry class for the day. In short, small schools must staff their classes with teaching generalists, rather than with teaching specialists.

3. While large school systems, even with multiple scheduling of classes in the same subject, have thirty or as many as forty students per class, small school systems are far more likely to enroll a scant fifteen students in any given group. Moreover, in second year courses such as advanced mathematics, chemistry, or language, class enrollments may dwindle to a mere three or four students. The implications of such differences in class size are both large in number and basic in their educational importance. Not only can instruction in small school systems derive maximum benefit from individualized learning experiences, but students in such a school system can look toward a qualitatively different kind of interpersonal relationship with their teachers than they possibly could have realized while enrolled in a large school. The sheer crush of numbers in the latter type of facility works

to make the teaching process a cold and impersonal one. Instruction tends to be formal, following rigid lock-step patterns, and is rarely marked with the special stimulus of a Socratic dialogue between teacher and student. Yet the very frequency of this kind of learning experience in a small school makes it potentially one of the richest educational settings available today.

4. Because large school systems are located in centers of high population density, they can also draw upon the technological stores which inevitably are part of almost any metropolitan community. Small school facilities, on the other hand, are set away from the urban quarter of society and, hence, will not be able to take equal advantage of the educational potentialities offered by the cities. This circumstance does not, however, work always to the disadvantage of students in small schools. Their rural setting often places them in a sector of society given over to the feeding or support of the great community centers, and in such a milieu there can invariably be found educational payloads of great significance which are, for all practical purposes, effectively cut off from the urban student.

Perhaps the basic concept which must guide planners of small school facilities is that of FLEXIBILITY--a requirement to be examined in further detail later in this paper. The special need of a small school plant to incorporate into its physical structures a high degree of almost instant adaptability far exceeds that

necessary for larger school systems. This very critical need primarily grows out of the differences between the two systems as discussed in the preceding paragraphs.

For example, because a large school system may find it necessary to schedule six or more classes each day in Speech and Drama, it may with the best of reasons design and construct a little theater in which instruction limited to those two arts is offered to the exclusion of all other activities. Such a facility, however, in a small school system would represent an inexcusable extravagance. Of course, Speech and Drama should be taught, but certainly not in a room which, because of its physical rigidity, cannot be put to any other educational use. Yet out of careful planning there could emerge a room equally suitable for instruction in Music or Speech and Drama. Moreover, the same space could be further adapted for selected activities in physical education or for use as a recreation center. This varied use might even be extended to include service as a dining commons or as a community gathering hall. What seems abundantly clear is that almost none of this structural versatility can ever be realized without the most careful pre-planning before the architect ever approaches his drafting board.

EDUCATIONAL SPECIFICATIONS

For most people the pre-planning of a school facility suggests the rolls of architectural plans over which construction engineers and skilled craftsmen pore as the building rises from footings to roof.

These same people are far less likely to think of the school planning which should precede even the architect's first preliminary drawings. Yet, just as the building should be true to carefully prescribed engineering specifications, so should the architect's plans emerge out of detailed educational specifications drawn with comparable care and consultation.

Too often a school facility is conceived, designed, and built with an eye primarily toward remaining within certain broad parameters of square footage, number of rooms, and total dollar cost. Just as frequently a new box-like building is routinely commissioned to replace another box structure now grown time-worn, weather beaten, and unsafe. There are thousands of such buildings throughout the country and hundreds more, unfortunately, are going up each year. While the new outer shells are perhaps more colorful than the drab fortresses which they replace, their teaching spaces within can turn out to be depressingly the same. Imaginative schools in which innovative teaching will flourish can emerge today only out of educational specifications which themselves have been drawn innovatively and with imagination.

The seeds for sound educational specifications lie in the questions: "What must this facility accomplish? What activities will it contain? What goals shall it help achieve?" From the answers to these questions can evolve a facility design resulting subsequently in a structure that does more than house and shelter students. The answers, in fact, have the ultimate potential of transforming ordinary building

materials into the component parts of an exciting and functional educational milieu. In their simplest conception educational specifications serve as a concise, yet comprehensive, guide to the architect as he sets about his manifold tasks of preparing engineering details for the new school plant. In this connection it is essential that the educational specifications be developed in great detail before the architect himself is selected--a requirement which says only that a buyer should know what it is he wants to purchase before he agrees to a sale. Certainly, to carry the analogy a step further, the salesman may exert his own expertise on the buyer to some extent, but surely all the details should not be left to him alone. This circumstance, however, is often forced upon the architect who is asked to design a school with little more than a layman's understanding of the educational program which will take place within it. The result is that the architect must become, perhaps unwillingly, a curriculum specialist, and though he may conceive a building of surpassing beauty and form, it may turn out to be an educational setting of no more than pedestrian quality.

Educational specifications drawn up by educators should reflect the educational program desired by the local district. The very process of agreeing upon such specifications demands a searching analysis of current educational practices by all concerned, as well as studies of other plants and programs. This inevitably generates conclusions regarding what is good and bad in both the old and the new facilities and lays the groundwork for incorporating the very best into the proposed structure.

In a recent research undertaking by Roaden, all of the foregoing points touching upon the advantages accruing to a school district which makes full utilization of educational specifications were brought out in considerable detail (Roaden, 1963). In addition, Roaden saw the development of educational specifications giving rise to other benefits including the following:

(1) stimulating curriculum review and improvement;

(2) translating community needs and values into functioning educational programs;

(3) serving as a vehicle for the in-service training of all school personnel; and

(4) furnishing a basic reference to the operation and functioning of the resulting educational facility.

In an analysis of general factors relating to educational specifications for small schools, Yulo made certain specific recommendations (Yulo, 1963).

(1) Facilities should include areas which serve a basic small group of from one to six pupils and which provide for the coordination of such groups rather than for the traditional groups of from 25 to 35 pupils.

(2) Facilities must provide for kindergarten through twelfth grade, often in one building, which facilitates the articulation of learning activities, as well as professional relationships, throughout all age levels, including adult education.

(3) K-12 buildings must have open areas in which space dividers can provide flexible living areas for two or more teachers each working with two or more groups concurrently, instead of the rigid partitions now found in many school buildings.

(4) Facilities should provide for the easy and rapid mobility of most equipment, storage cases, and space dividers to achieve optimum allocation and varied use of space and equipment, and to permit flexibility of scheduling. This implies more storage space with less space for halls and walls.

(5) Space, furniture, and equipment should be so planned and designed that the building functions more like the home which informally serves small groups than like the factory which is specialized and highly organized for mass action.

A guiding thought in the drawing of educational specifications should be that every component of the planned curriculum will require a space, a physical setting, in which it will be taught; it is imperative that each such space, together with its collateral requirements, be included as part of the specifications with which the architect is provided.

Only with this kind of pre-planning will it be possible to realize a school facility deliberately tailored to the unique and multiple requirements of the educational program which will occur within it. The unpleasant and altogether unnecessary alternative is the prospect of struggling with fitting a curriculum to the essentially unyielding nature of a finished building.

PLANNING FOR THE SCHOOL ENVIRONMENT

Flexibility

As emphasized earlier in this paper, the small school in particular must seize every available opportunity to build flexibility into its physical plant. In a careful study of these requirements, Gilmore urged the construction of continuous floors and ceilings with the provision of a minimum of load-bearing walls (Gilmore, 1965). There should also be planned both movable and folding partitions to allow for either large or small-space instructional centers. To maximize the inherent versatility of such a facility, care must be taken to place utility lines so that they will in no way diminish adaptability.

While movable walls and partitions may be the most striking aspect of flexibility in a school, the concept must be resolutely carried well beyond the obvious expedient of rearranging wall placements if it is to be truly effective. Heating, air conditioning, lighting, furniture, and storage units must be equally adaptable to the changing space requirements.

The architect's problem of increasing the flexibility of a school plant may be measurably lessened if he can be advised with some detail of the different educational activities envisioned for a given room or space. His problem can be eased still more if he can be apprised of the nature of the two or more activities which may be contemplated as occurring in a single space simultaneously. While this underscores once again the necessity for preparing educational specifications early in the program of readying a new school facility, it also recognizes the architect's own creativity will be additionally stimulated if it can feed on the special thoughts and ideas of the educational planner.

One aspect of flexibility not discussed to this point concerns the ease with which structural adaptability can be realized within the course of an ordinary school day. A movable non-load-bearing wall, which nevertheless requires skilled workmen a week to rearrange, is of questionable value. The small school in particular will have frequent cause to change a large space into several smaller ones or vice versa, and this transformation must be accomplished in no more than a few minutes, safely carried out by the teacher and her students.

Open Space Plan

A concept that is attracting new adherents every year among school architects and educators is the open space plan. This approach to construction eliminates many of the internal load-bearing walls, not only providing more usable space in which to carry on the educational program, but making possible numerous open areas in which two or more activities can be carried on at once. In a study comparing schools that emphasized the open space plan with schools that did not, the open space plan was found to be superior in that flow of students and teachers from one activity to another was more rapid and was not impeded by the usual corridors (Kyzar, 1962). More importantly, much of the space traditionally given over to intermittently used corridors was brought into full and productive educational use.

The most frequently voiced criticism of open spaces--that noise emanating from adjacent activities would be disrupting to both groups--Kyzar found not significant when proper acoustical materials, properly designed, were employed. There seems little doubt that such failure to solve relevant acoustical problems would bring failure to the open concept. Yet interestingly enough, what has gone unrecognized for years is the long-standing failure of schools to show concern with those acoustical factors in standard, walled-off rooms which have made deep in-roads into the efficiency of those settings as places where children must learn. The galaxy of outside traffic noises and the periodic excitement of corridor sounds, both of which continually assail the ears of students in traditional classrooms, can be just as distracting as would be sounds coming from some other quarter within one teaching space. In a report by

John L. Reid (a noted school architect), however, it was emphasized that the design and installation of acoustical materials has now reached a sufficiently high quality level that it is possible to create a moderate-sized room where activities in one end are inaudible at the other; in addition, the extraneous noises originating outside the space can be almost entirely sealed off from those persons within it (Reid, 1963). With the advances recorded in recent years in the manufacture of sound dampening materials, there has come a new enthusiasm for the use of audio-visual aids which now can be employed with real confidence that they are not a disturbance to other nearby groups of students.

Acoustical Floor Cover

A principal factor in reducing the noise level in schools today is the installation of floors covered with carpets. After a decade of extensive trial and study, there are no longer significant criticisms of carpeting which have not been effectively set aside by impartial assessments.

It is well known that the installation cost of carpet is usually greater than that of non-carpeted floors; when maintenance costs are compared, however, the combined cost of carpet installation and maintenance is quite favorable. Writing in the American School Board Journal, Hovey (1964) presented a detailed cost analysis showing that the maintenance of asphalt tile was as much as ten times that expended on a like amount of carpeted area. It would now appear that most resistance to the use of carpeting arises from attitudes which picture it as an educational frill or an extravagant luxury to be avoided in the interests of economy. The problem for increasing its use seems at this point to center upon the proper dissemination of relevant information.

While the dollar factor cited above should alone be sufficient to warrant the inclusion of carpeting in new school facilities, the bonus acoustical features of carpeting make its use virtual necessity. Carpets will muffle, if not eliminate entirely, the usual distracting classroom sounds of scraping furniture, footsteps, and clicking heels, as well as the dropping of books and pencils. Moreover, these same noises orginating in adjacent rooms and hallways do not filter in to the classroom as is typically the case because they, too, are eliminated at their source. Students and teachers alike speak of a relaxed, comfortable atmosphere which is brought to a room with the addition of carpeting. It appears also to ease that cold, harsh institutional quality of a school which contributes to mounting student irritability and teacher fatigue as the day wears on.

For the lower grades in particular, a carpeted floor affords a comfortable and inviting space on which children may sit or lie for a wide range of school activities which could not even be contemplated with hard surface flooring. Conrad and Gibbins (1964) reported that elementary school students learned more in carpeted rooms than a matched set of students learned in rooms with hard surface flooring. They attributed these observed differences in learning to the near-optimal acoustical control achieved in the carpeted classrooms. The superior friction of carpeting reduces the incidence of slips and falls, and its greater resilience lowers the proportion of injuries when falls do occur. Finally, the home-like air imparted to schools by carpeted floors tends to quicken the housekeeping concerns of students with the result that far less refuse is dropped than is normally true for ordinary

flooring. In a word, the case for carpeting in schools now appears to be almost overwhelming.

Lighting

Of special concern to both large and small school facilities are the multiple problems of lighting. Today's engineer, in contrast to his counterpart of thirty years ago, has a rich fund of lighting data upon which he can draw, together with an array of lighting fixtures and related technology unlike anything available when the engineer himself was in school. The University of Michigan has compiled a collection of annotated abstracts that presents a review of existing literature concerning the nature of lighting conditions which are conducive to learning (Larson, 1965). The results of these studies, as well as their implications for building design, equipment and fixture procurement, and implementation during the course of the school day, are all available to any educational planner. Guides and indices to determine light requirements for different types of visual tasks have been worked out in such minute detail that the importance of classroom illumination need no longer be left to guesswork.

The rule that the task area for students should never be lighted less brightly than that of the surrounding area proves to be a good deal easier to state than to follow. In many of the older school buildings which depended heavily upon windows as a source of light, the rule was violated often and in different ways. For example, on bright, sunlit days students near the windows could attend to their tasks in adequate

light with the more dimly illuminated areas of the room properly in the periphery of their vision. Their classmates seated further from the windows, however, not only strained to see their work in insufficient light, but found their eyes continually drawn to the other side of the room where the light was brightest. At different occasions on overcast days or during the late hours of winter afternoons when window light was meager and it was necessary to supplement it with old-styled electrical fixtures, the classroom became patterned with numerous circles of bright and dim light, inadequate for some students and distracting for others.

Today it is possible to plan the lighting of a room in such a manner that the variable quantities of light from natural sources may be compensated for by either raising or lowering the level of artificial illumination; those sectors of the room benefiting least from natural light may be flooded with sufficient additional light to equalize the foot-candles of illumination over the work area of each student regardless of his position in the room. Equipment is also available which permits the teacher to alter the general illumination in response to the requirements of different classroom work or assigned activities and to make all such adjustments and readjustments with control devices that insure the accuracy of settings.

Thermal Requirements

Just as the school environment demands optimum levels of illumination to facilitate learning, it must also include those thermal features which maximize individual comfort in the educational setting. The old and the new schools differ quite as much in their thermal characteristics as they

do in their illumination. Old structures were heated most frequently by massive radiators, irregularly spaced, causing those students close by to swelter and perspire while their friends a few feet away shivered in discomfort. What little exchange of air occurred was achieved by raising or lowering double casement windows--an option that the teacher regrettably was obliged to abandon when outside conditions were inclement, windy, or filled with dust.

Though suggestions to install a fully-regulated thermal environment, including air conditioning, are frequently met with automatic cries of extravagance (much as occurs with recommendations for carpeting), evidence is mounting to indicate that money expended on such features may well be the best-spent dollars of all. Following a study of the thermal environments of schools, Bruce concluded that the efficiency of students and teachers is affected by many physiological factors operating within a building, with one of the most important being the provision for a controlled and adequate rate of body heat loss. He felt, moreover, that this could be realized only through the scientifically regulated removal or introduction of heat and a continuous cleansing and exchange of air (Bruce, 1960).

The University of Iowa and Lennox Industries, Inc., have completed studies showing marked improvement in the learning efficiency of students when placed in a model thermal environment (University of Iowa, 1963). These same investigators have reported other findings which indicate that the apparent expense of air conditioning could turn into a genuine economy. In this connection they found that with new air admitted to the building mainly through mechanical devices where it was

first cleaned and humidified, the entrance of airborne dirt was virtually eliminated. This brought a dramatic reduction in cleaning and janitorial costs. It also signficantly slowed the discoloration of walls and ceilings, thereby substantially lowering subsequent redecoration costs. In addition, Lennox researchers have been able to show that in the drafty, poorly-insulated school buildings now being replaced, there was often an enormous overproduction of heat because so much that was generated was needlessly wasted. In contrast, the carefully regulated thermal environments available today can accurately utilize BTU's produced by lighting, building machinery, and the body heat of students and staff, adding only that amount necessary to bring the environment up to the optimal level of warmth. So efficient can be the use of this incidental heat that on a zero-degree day there was in one test building enough heat to permit the maintenance of an adequate balance without any use of the heating system. In fact, as the outside temperature moved above zero, a cooling situation arose.

Adding to these substantial advantages accruing with the use of air conditioning and modern thermal features, are the equally important (though perhaps less objectively measured) factors of physical health and personal comfort. Clearly, the airborne contaminants of smog are health hazards which can now be effectively excluded from the school environment. A thermal environment which contributes to the making of comfortable and efficient students makes similar contributions to those who teach them. One can expect teachers to be attracted by a

pleasant environment and their natural disinclination to leave such a work setting will add to the stability of the instructional staff. Indeed, it now seems that, like the arguments for illumination and carpeting, those favoring a complete thermal environment have become too numerous and too persuasive to be effectively disputed.

The Small School Library

Though some of the preceding comments touching upon factors of illumination, acoustics, and thermal environment may be no more critical to the total success of small schools than to that of large ones, they are nonetheless included because they so manifestly work to escalate the productivity of the schools in which they are employed; further, the authors are convinced that small facilities in particular must grasp every opportunity to fashion the best of learning milieus. However, in focusing attention upon the needs of a library, the unique requirements of a small school are once again asserted.

Although a recent conference of library and communication experts closed with the conclusion that the next twenty years will see a vast increase in computer technology as it is related to the mission of libraries (including expanded use of microfilm and audio tapes), the book will remain the major medium for transmitting information (Educational Facility Laboratories, 1967). The library of the small school may, however, lead the way in pressing for the increased utilization of technological advances; every indication points to these advances as eventually becoming the more economical means of increasing

the number of library holdings and acquisitions when compared to the alternative of purchasing and storing the standard, hard-cover printed matter.

Fortunately, the small library can dispense with the great reading rooms so commonplace in large libraries and concentrate its resources upon providing small spaces, including numerous one student carrels, where the opportunity for individualized instruction can be especially emphasized. The small study space, whether for one or half a dozen students, can now be designed to permit activities far beyond those of undisturbed reading and writing. The same carrel which provides undisturbed reading and writing can also be pre-engineered so that films may be viewed there with earphone audio to prevent interference with activities under way in adjacent areas. Microfilm material can also be studied and language tapes can be made and reviewed; maps, charts, and graphs can also be stored in the carrel for prompt retrieval. As is the case for other schools of different sizes, the small school library must remain the hub of all learning activities; the demands upon it will be too great and too varied ever to allow any one large section of it to be given over entirely to a single activity. All of the architect's and the educational planner's ingenuity for flexibility must combine to produce a small library designed to shoulder much of the load of learning for an entire school.

SUMMARY

This paper has sought to direct attention to a number of planning requirements of particular concern to those who share the responsibility

of developing today's small school facility. Heading the list of such requirements is the need to draw up educational specifications which tie every component of the curriculum to that portion of the facility where the two will come together. In planning the school environment, the watchword should be "flexibility" to insure both the maximum utilization of space as well as the fullest expansion of curricular activities. Open space plans designed in conjunction with carpeted floors and the use of other acoustical materials are recognized means of increasing school flexibility. Recent advances in school illumination, air conditioning, and thermal control have so improved the school facility that it would be a serious error to fail to take full advantage of them. Finally, the small school library should make extensive use of new library technologies for the acquiring, storing, presenting, and retrieving of materials; it should also be prepared to offer the physical setting for individualized instruction which is one of the special advantages accruing to the student enrolled in a small school system.

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